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H4R
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(54) **Improvements in voice switched amplifiers**

(57) In a bidirectional telephone line amplifier the direction of amplification of which is arranged to be switched in accordance with the direction of incoming voice signals, means is provided for sensing the voice frequency power appearing at each input terminal pair in turn whilst the amplifier is amplifying in favour of that input signal, and for adjusting the appropriate switching threshold of the amplifier in order to compensate for incoming voice signals of different amplitude in the respective directions of amplification.

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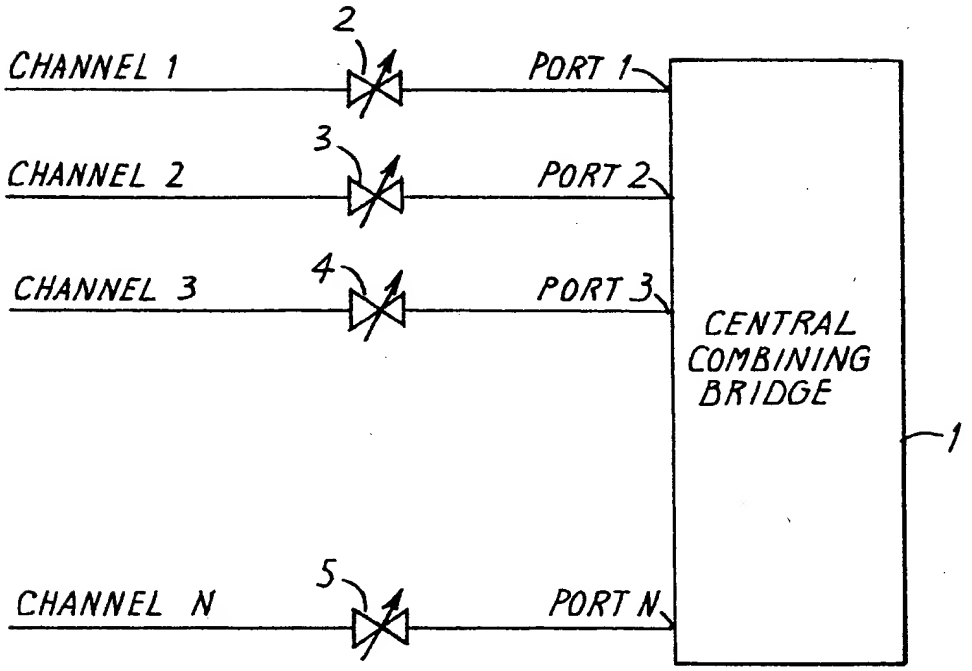

FIG. 1 TELECONFERENCE COMBINING BRIDGE WITH AUTOMATIC GAIN CONTROLLED AMPLIFIERS

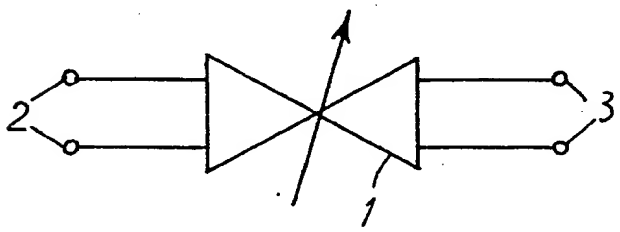

FIG. 4

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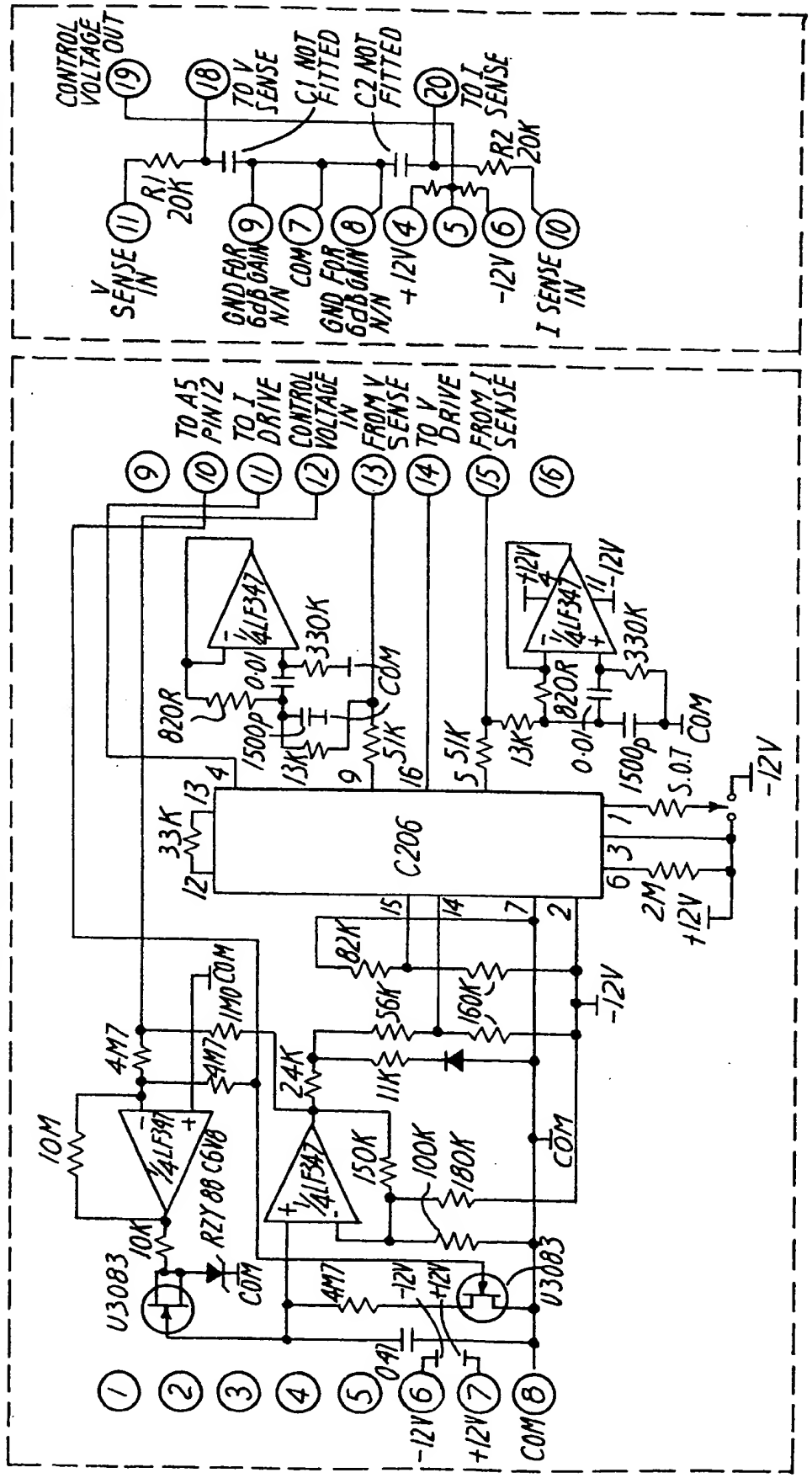

FIG.2

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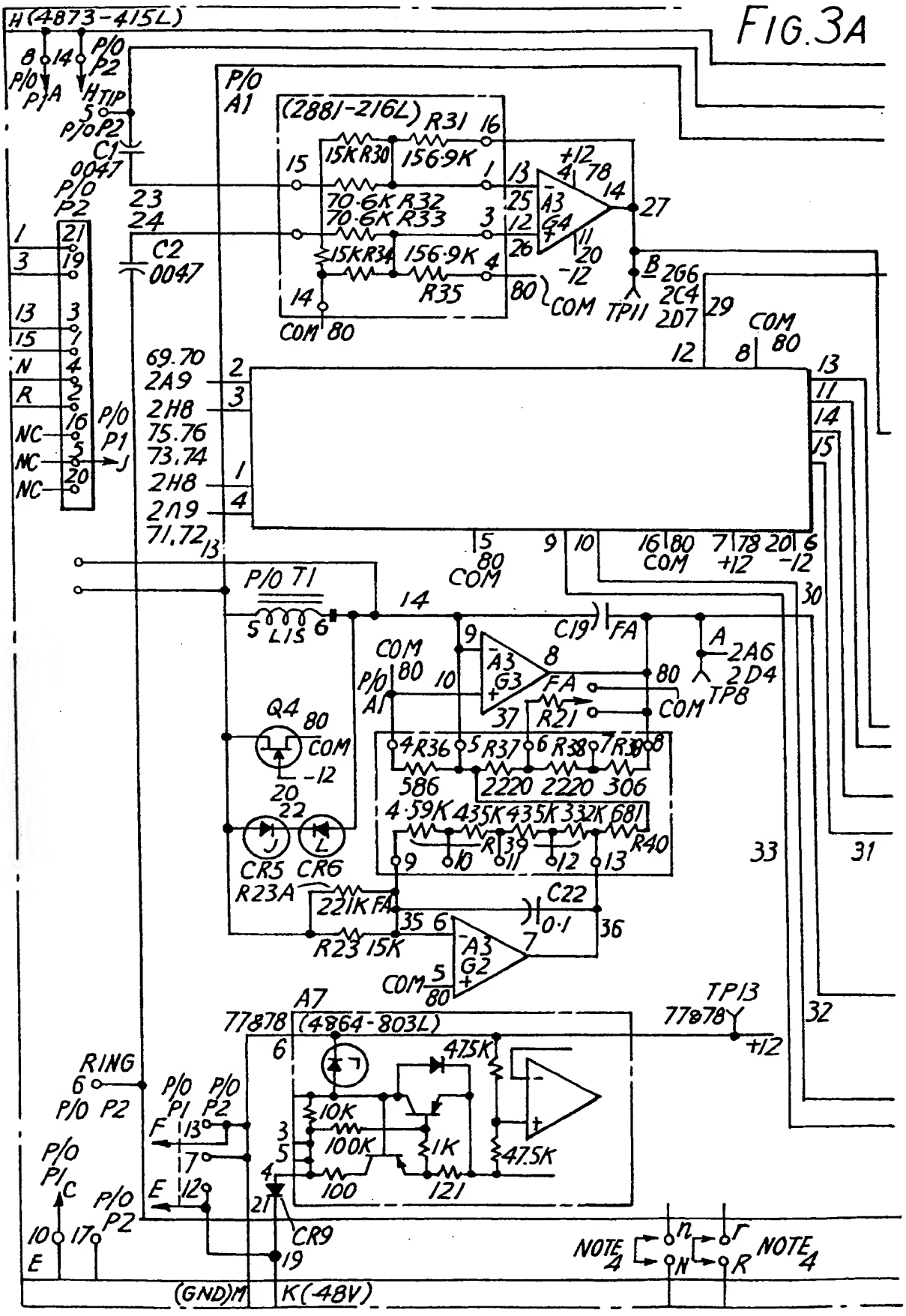
FIG. 3A



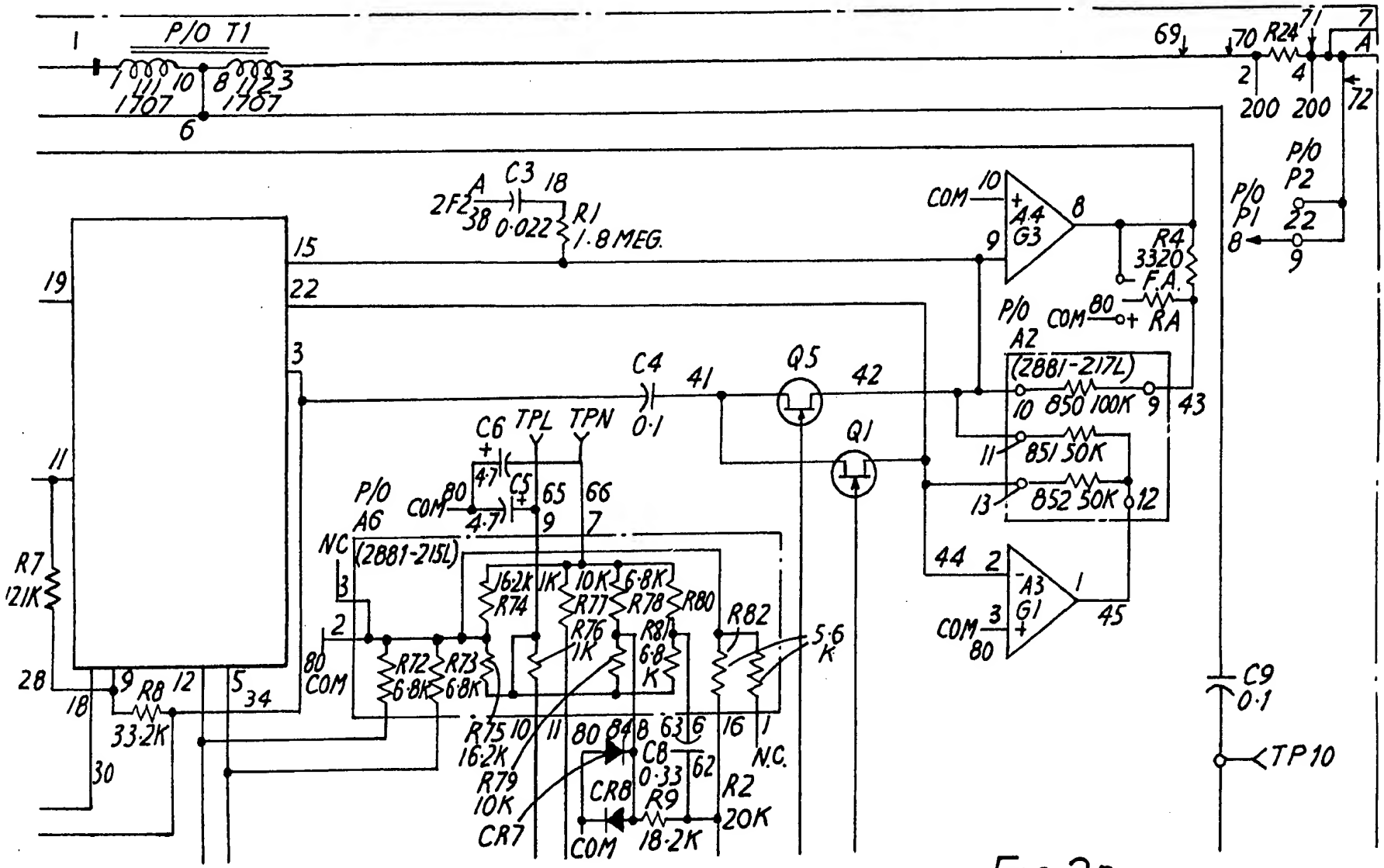

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FIG.3B

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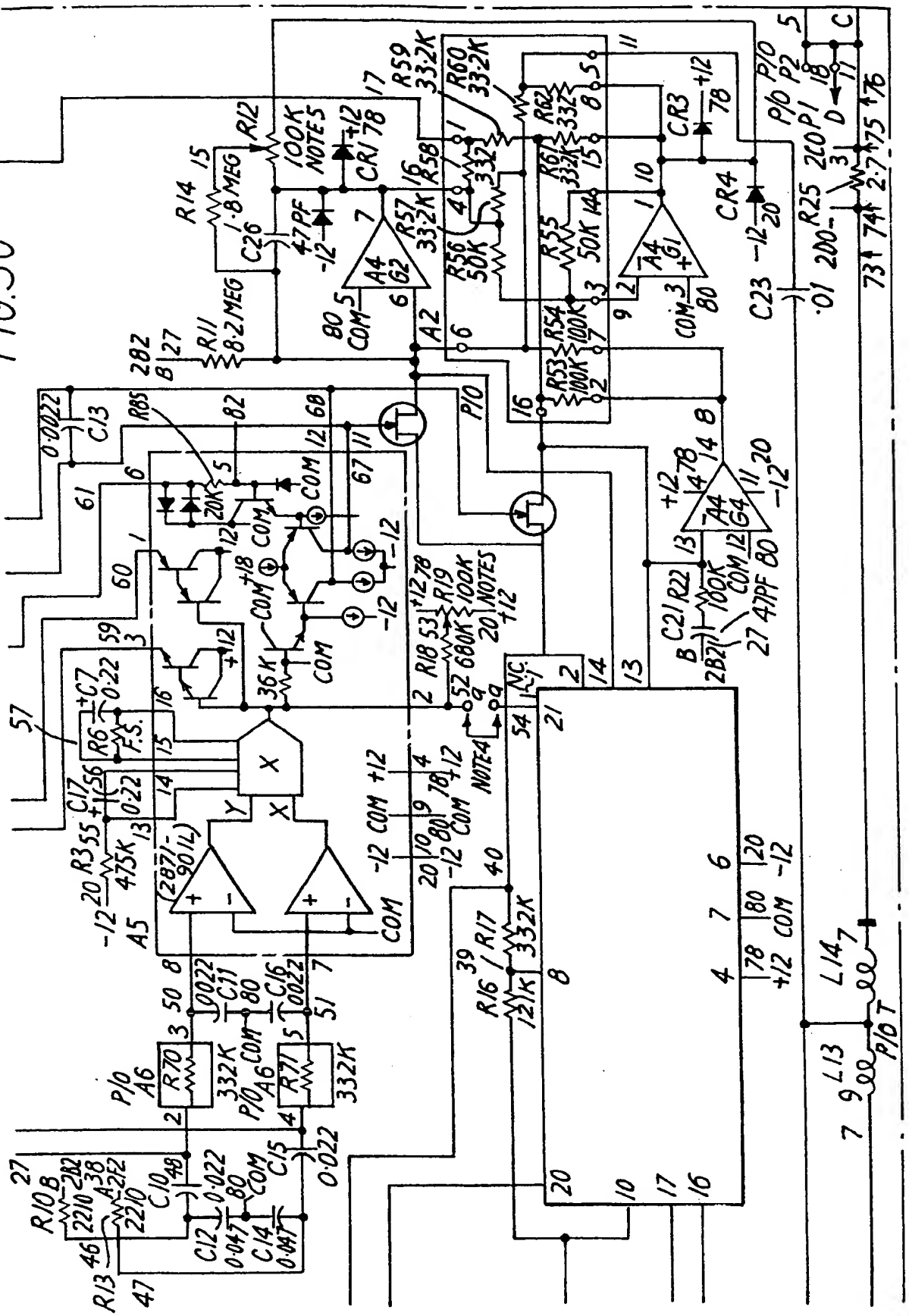
FIG.3C



SPECIFICATION

Improvements in voice switched amplifiers

It is well known that stable two wire bi-directional telephone line amplifiers may be constructed by so arranging the circuitry as to ensure that the overall loop gain of the device is kept below unity at all times. One of several amplifiers of this type is that described in UK Patent 1393384 by Lorain Products Corporation.

Line Amplifiers of this type amplify the dominant direction of speech at any time and introduce a compensating attenuation in the reverse direction of transmission so as to ensure that overall loop gain does not exceed unity. This is more completely described in the above mentioned UK Patent, as is the technique used to determine which direction of transmission is dominant at any instant.

All such amplifiers, together with many other voice switched devices such as echo suppressors and loudspeaking telephones for example suffer from the disadvantage that the detecting means employed for determining the presence of voice frequency signals for passage through the device must be both sensitive enough to rapidly detect and respond to valid signals, whilst being insensitive to noise on the circuit. The wide range of signal and noise levels encountered on the national and international telephone networks of the world makes it impossible to establish a single threshold level which is both sensitive enough to ensure that a weak distant party is properly amplified in the face of noise induced on a short more local circuit connected to the opposite side of the device.

This problem is particularly apparent in teleconferencing applications where breathing and other background noises on short local circuits may seize the amplification of the teleconference bridge system, so impairing its response to weak distant parties. An objective of the present invention is to ensure that the switching threshold is so regulated as to ensure that weaker parties are favoured by reducing the switching threshold in their favour. Similarly the switching threshold on shorter more local circuits is raised to increase their immunity to false switching due to noise. This is achieved by sensing the voice frequency power (peak, R.M.S. or average) appearing at each input terminal pair in turn whilst the amplifier is amplifying in favour of that input signal, and adjusting the appropriate switching threshold accordingly. This greatly reduces the perceptibility of voice switching and reduces the incidence of noise breakthrough from short local circuits interfering with signals from distant parties.

For multi-party teleconferences to be effective, a reasonable balance of voice frequency levels is necessary between parties. As the attenuation of each line is not known in advance, the amplification required to balance speech levels on the conference may vary widely from circuit to circuit. This amplification is, by means of the present invention, regulated as a function of the incoming speech level on amplification on each circuit is maintained for signals passing from the combining bridge to each distant participant.

By this means, local parties are attenuated and distant parties amplified so as to ensure that the speech level appearing at the central combining bridge is equal for all parties. As equal amplification is maintained for signals out of the bridge on any port or channel as that required to bring incoming signals on that channel up to a standard reference level, the speech levels perceived by each participant are thus well balanced.

Figure 1 shows a central combining bridge (1) which may itself take one of several forms ranging from a fully bi-directional passive or active bridge where incoming signals appearing at each port are summed and appear as outgoing signals at every other port, often attenuated by some degree to aid stability; or alternatively be 'voice switched' in that only one channel is permitted access to the bridge at any instant, all other channels amplifying out of the bridge at that time. In the latter case, amplifiers (2) to (5) may form part of the central combining bridge itself, and the adaptive switching threshold and gain control functions which are the subject of this patent application may equally well be applied directly to the central combining bridge.

Amplifiers (2) to (5) must generally be voice switched in characteristic as considerable amplification is often required and the terminating impedances presented by the circuits connected to channels 1-N are frequently unknown or poorly controlled.

In applying the present invention the threshold at which amplifiers (2) to (5) elect to amplify incoming voice frequency signals from the channel with which they are each associated is arranged to increase with increasing incoming voice frequency levels appearing on the channel. The switching action of the amplifier is thus more sensitive to weak, distant parties than to stronger more local parties. In absolute terms we have found it desirable to increase the sensitivity of the switching threshold for speech signals having a peak level of −20 dBm or below to −54 dBm approximately whilst arranging for the threshold to be raised to approximately −38 dBm or more for strong local parties. This is achieved by the circuitry shown in Figures 2 and 3.

In addition to adaptively varying the switching threshold of amplifiers (2) to (5) in response to incoming speech levels, the circuitry shown in Figures 2 and 3 is so arranged as to alter the gain of each amplifier so as to maintain the incoming levels appearing at Ports 1 to N on Figure 1 as uniform as possible. Channel 1 may, for example, be connected to a distant party generating an incoming peak speech level of −18dBm. Amplifier (2) may then regulate its gain to 18dB giving a peak speech level at Port I of OdBm. Strong local parties may, on the other hand, generate peak speech level os +10 dBm in response to which the gain of the associated amplifier may reduce so as to introduce a loss of 10 dB approximately, so ensuring that the incoming speech level to the combining bridge is maintained